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REPORT OF THE EXPERT WORKSHOP/EXPERT MEETING ON THE DEVELOPMENT OF INDICATORS OF SCIENCE AND TECHNOLOGY FOR THE CARIBBEAN

Port of Spain, Trinidad, 25-26 May, 2000

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Introduction

Efforts at the popularization of science and technology in the Caribbean and programmes aimed at introducing a culture of science and technology in Caribbean society have had mixed success over the past decade. These programmes have suffered from a lack of support from both policy makers and the general public. In 1988 a Regional Policy on Science and Technology was developed with assistance from United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Economic Commission for Latin America and the Caribbean (UN ECLAC) and the Caribbean Council for Science and Technology (CCST). The policy identified the need to create greater awareness of science and technology in the development process, and for greater attention to be paid to scientific and technological issues in the development of projects and programmes that can promote sustainable development in the region.

Unfortunately no reliable sources of information relating to the use of science and technology or the contribution of science and technology to the development efforts were available to assist in developing programmes or inform policy. UNESCO and CCST undertook a survey of science and technology-related activities in the Caribbean in 1983, but the information proved to be very static and did not provide the basis for comparison or policy-making. Efforts have been made from time to time at incorporating information from the Eastern Caribbean States into the publication of the Red Iberoamericana de Indicadores de Ciencia y Tecnologia (RICYT). Because of the paucity of information and data from these States, it was decided that a programme to incorporate the required data in the RICYT publications was of utmost importance.

In 1997 and 1998, RICYT funded two resource persons to conduct seminars in the Caribbean on the role of indicators in policy-making and the problems associated in the development of an indicators programme. Participants were drawn from 14 Caribbean countries and included persons responsible for science and technology, through National Science and Technology Councils and/or the Ministries of Planning. Participants were introduced to the various manuals available on indicators, the terminology, approaches and interpretation of indicators as put forward by Australia, Canada, the United States of America and the Organization for Economic Cooperation and Development (OECD).

While these manuals provide background information, it was recognized that they would be of very limited value as the focus of the developed States, more related to research and development, was outside the scope of most of the Caribbean States. It was agreed, therefore, that efforts should be made to develop a programme that would be more meaningful to Caribbean countries, while at the same time providing some compatibility to developed countries for analysis. It was also agreed that indicators identifying human resources in science and technology-related activities and expenditure on science and technology would be the first set of data collected.

The present situation

In late 1999 meetings were held in Port of Spain, Trinidad and Santo Domingo, Dominican Republic, to agree on those indicators of science and technology that would be of importance to very small States in the context of participation in the Regional Programme managed by RICYT. Since it had been agreed that indicators identified for large States would be of little value to very small States and that the present literature focused primarily on large States and their activities, the meetings, therefore, developed a set of indicators and prepared a preliminary questionnaire for consideration and discussion by a group of experts at a subsequent meeting. It was agreed that an Expert Group Meeting would be held early in 2000 to finalize the document and to initiate the process of data collection for the development of indicators of science and technology. (See Appendix II for the report of the meeting held in Santo Domingo)

On the basis of ongoing work and the need to expand efforts in this area representatives of five countries were selected to participate in the Expert Group Meeting. These countries were Barbados, Guyana, Jamaica, Saint Lucia, and Trinidad and Tobago. Participants from these five countries made presentations on the status of the science and technology indicators programme at the national level; on efforts made in promoting the programme and the level of difficulty encountered so far in the collection of the data. The agenda for the meeting is at Appendix I.

COUNTRY REPORTS

Jamaica

Although a science and technology indicators programme had been introduced two years ago, considerable difficulty was being experienced in obtaining information, even from the public sector. Most persons did not respond to the questionnaire and those who responded did not always provide the required information. It was also necessary to train persons in the completion of the questionnaire and to introduce some measure of uniformity into the interpretation of questions and answers. Some difficulty was also encountered in the development of the questionnaire itself. The general consensus was that a regional programme would provide some uniformity and comparability to the national programme. The national programme is part of the efforts of the National Council on Science and Technology of Jamaica, chaired by the Prime Minister.

Trinidad and Tobago

The Trinidad delegate reported that the Government had obtained the assistance of an official from the Science and Technology Council in India through the technical assistance programme of the Commonwealth Secretariat. The officer is attached to the National Institute for Higher Education, Research, Science and Technology (NIHERST) and has assisted in the development of a questionnaire; shared some of the problems experienced by India in the development of their indicators programme and the approach to the collection of data for indicators. He also provided some valuable information on the issue of innovation. Trinidad and Tobago has therefore been collecting relevant information on science and technology activities in the country as well as information on innovation over the past and will shortly publish a booklet on the topic. However, the Trinidad and Tobago representative noted that they were experiencing the same problems as Jamaica in obtaining the information.

Guyana

Although the Institute of Applied Science and Technology (IAST) has recognized the need for collecting information on science and technology activities in Guyana, it has not undertaken such activity. It is hoped that the present effort will assist the Institute in the introduction of the indicators programme.

Barbados

The National Science and Technology Council will be undertaking the project and has identified an individual for the conduct of the survey.

Saint Lucia

The Ministry of Planning, through the National Science and Technology Council will be undertaking the survey.

GENERAL DISCUSSIONS

Questionnaire

The workshop participants considered the questionnaire prepared in November, the level of difficulty associated with the collection of data and the available sources of information from which the indicators can be derived. It was agreed that two additional questions should be included to address the issues of Internet use and innovation. With the inclusion of these two points, it was agreed that the results would provide sufficient information for incorporation into the RICYT publications, as well as to provide an indication of the status of science and technology in the region. The final questionnaire is appended as attachment III.

Data collection

On the issue of data collection it was agreed that every effort should be made to obtain the data. Since this is the first exercise of that nature to be undertaken in the region, it was recognized that certain difficulties would be expected. Traditionally, it is difficult to have access to information from the private sector and although it should be relatively easy to obtain information from the public sector, there is no mandate that requires the ministries to be cooperative in providing information on a routine basis. In addition, it was recognized that science and technology-related activities are more pervasive in the private sector and information from that sector would therefore be of utmost importance.

Sources of information

It was agreed that general economic information exist and sources such as the United Nations Development Programme (UNDP), the Caribbean Development Bank (CDB) and ECLAC would provide sufficient material for the economic section of the questionnaire.

At the end of the workshop, it was agreed that:

1. There would be a pilot project involving five countries, namely, Barbados, Guyana, Jamaica, Saint Lucia and Trinidad and Tobago. Data collection would begin from June 2000.

2. The data obtained from the five countries would be published and forwarded to all Caribbean Heads of Government.

3. In December 2000 a meeting would be held in Grenada to present data collected, introduce the indicators programme and a concerted effort be made to popularize the programme at the national level.

4. The programme, when fully operational, would contribute regional policy decisions on science and technology.

5. While data would not be immediately collected, it is anticipated that the five States participating in the programme will begin to collect data on innovation by 2001 to be followed by other States.

6. Consideration should be given to the convening of a meeting of Ministers with responsibility for science and technology in the region to introduce them to the indicators programme. The meeting should also provide the staging ground for a more focused programme in science popularization, policy making, agenda setting, food production, industrialization, science education, environmental management and inculcating a culture of science and technology in regional societies.

List of attachments

Appendix I: Expert Meeting Objectives and Agenda
Appendix II: Report on Meeting of Indicators held in Santo Domingo
Appendix III: Questionnaire
Appendix IV: Country Reports
Appendix V: List of Participants

APPENDIX I

SCIENCE & TECHNOLOGY INDICATORS IN THE CARIBBEAN

TRINIDAD AND TOBAGO

25 & 26 MAY, 2000

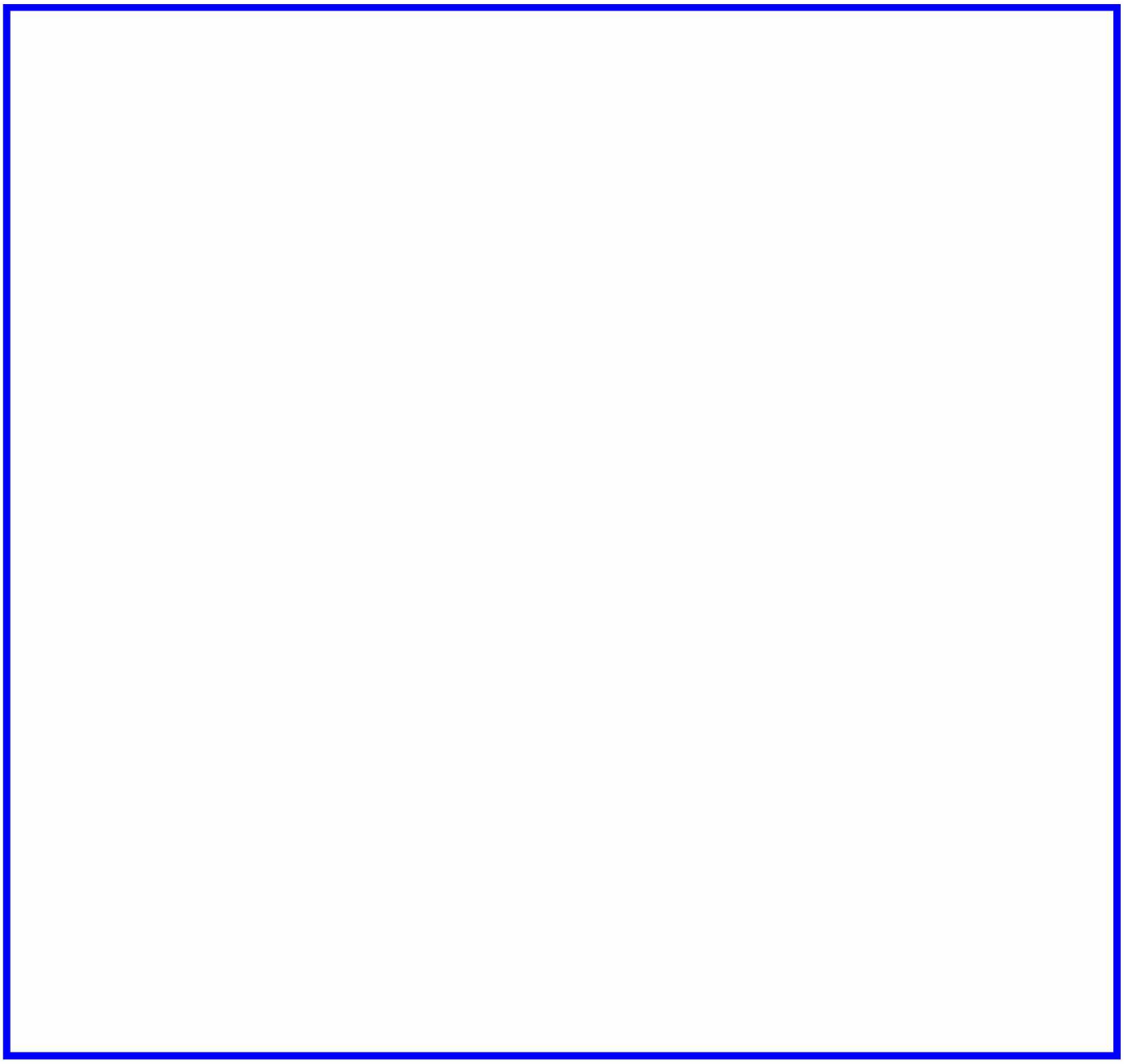
Funded by OAS/RICYT

Meeting Objectives:

1. To develop a strategy to ensure consistency in the collection and interpretation of Science & Technology Indicators for the Caribbean region.

2. To provide an opportunity for participants to become fully knowledgeable with all aspects of the Canberra manual from which the indicators on human resources were selected.

3. To provide an opportunity for participants to answer and explain any queries which may arise in the exercise of data collection.



APPENDIX II

A Caribbean Approach to S&T Indicators
Report on the CCST Workshop on S&T Indicators
Port of Spain, Trinidad and Tobago
October 26 – 27, 1999
and
Santo Domingo, Republica Dominicana
1 November, 1999

Introduction

The formulation of science and technology (S&T policy and the development of S&T plans and programmes for the promotion of sustainable development and innovation require up-to-date, reliable and comprehensive data on a country's scientific and technological potential as well as its resource base.

Over the past two years there has been a growing need in Caribbean countries for an information system and database on S&T statistics (popularly known as "Science Statistics"). Policy makers, particularly those concerned about planning, implementation and management of technology issues, felt the need for comprehensive information, not only on the use of input resources which comprises mainly the financial and human resources deployed and infrastructure available for S&T, but also the output of such activities measured in terms of increased productivity and increased economic growth and the use of new technologies and their impact on society. Such information is considered useful for undertaking cost benefit analysis and other economic studies as well as for efficient programming, planning and budgeting. It will also help in comparing the national S&T efforts with other developing/developed countries.

Background

S&T indicators fulfill several functions:

- signaling or monitoring: giving insight and calling attention to developments and trends in the S&T system and its environment;
- accountability, evaluation and allocation: setting and justifying S&T budgets and giving insight into the performance of the S&T system against the goals established by policy makers and planners;
- legitimization: support for existing policies; and
- awareness: providing information to set aside prejudices and incorrect perceptions of the performance of the S&T system.

In the public sector, statistics on S&T inputs and outputs, and the consequent S&T budget, should support the following activities:

- formulation of S&T policy, in support of economic and social objectives including analysis of the national system of innovation;
- provision of advice to ministers and other senior officials;
- support for and justification of S&T program expenditures; and
  information on scientific activities for elected officials, journalists and other stakeholders.

Most nations have one or more governmental or not-for-profit agencies charged with collecting and analysing S&T data. These are sometimes referred to as S&T observatories. Herman Jaramillo, in writing about S&T observatories has noted that an observatory, as an agency for collecting and processing indicators:

> *"helps society to understand S&T development and the integration of S&T variables with other measures of economic and social development. The resulting information becomes a public good and a necessary input for the development of society."*

The mandate of S&T ministers, ministries and institutions everywhere is to harness S&T to support social and economic development of the nation. In practice this means that the over-riding question to be addressed by quantitative studies of S&T activities is "What is the state of S&T in the nation?" In the case of Caribbean nations this becomes a two-fold question – "What is the state of S&T in the nation?" and "What is the state of S&T in the Caribbean?"

In practice this means looking at changes in the levels of human and financial resources devoted to S&T (as inputs) and the change in the level of national development (as the desired output). Human resources for S&T are the common denominator among all nations – S&T programmes, are, by definition, carried out by skilled S&T professionals. In the Caribbean context, the allocation of human resources is more indicative of the distribution of S&T assets than actual expenditures. Thus, it is possible to define what is, and is not, an S&T programme by asking whether or not S&T professionals are a component of the programme.

There are two universes which intersect - that of all people trained in S&T fields of study and that of all people who are working as S&T professionals, regardless of their formal training. The sum of both universes is the area that is of interest to policy makers, although the policies may differ for the two. Indeed, it is important to know the magnitude of the two universes and the degree of overlap between them.

The Caribbean Council for Science and Technology (CCST) has sponsored a series of workshops on S&T indicators. At the most recent workshop, participants agreed on some basic indicators of S&T performance. These indicators were felt to be consistent with S&T policy interests that most CCST member countries would have in common. The CCST-recommended S&T data collection process is at two levels:

- data collected and reduced from a specific, common, questionnaire outlined below
- national economic data.

National S&T performance data

National S&T performance data is keyed to the identification of S&T activities, as defined by S&T-related occupations and their activities, whether S&T or not, of individuals trained in S&T-related fields of study. It was felt that the national responses should include both an S&T policy statement, as well as specific quantitative measures of performance.

The proposed common Caribbean S&T questionnaire is based on the collection of data from all projects, institutions, establishments, etc., which employ S&T professionals. If a programme has S&T professionals working in it (as defined in the OECD Canberra manual) then it is included in the survey.

HRST, as defined by the Canberra manual includes individuals trained in both the natural and social sciences and individuals working in occupations that are contained within the definitions of natural and social sciences. The test as to what should be included and what should be excluded is whether the field of study or occupation falls within the mandate of a nation's S&T policy or programme. If there is any doubt, then the test is whether the field of study or occupation would contribute to the development of a new product or process within the establishment in question. Some draft definitions are attached.

Economic and social data relevant to S&T activities

1. Population
2. Labour force
3. % of population with post-secondary education
4. GDP (US$)
5. GDP/capita (US$, ppp)
6. Exports as % of GDP
7. Imports as % of GDP
8. Foreign Direct Investment
9. KwH/capita
10. Telephone lines per 1000 population
11. Internet hosts/1000 population
12. Computers/1000population

An excellent source for national economic and social data is the figures published by the UNDP in the annual Human Development Report.

Specific CCST S&T indicators

13. Public sector personnel performing S&T (including R&D) as a percent of total public sector employment – *Public sector as defined in the Frascati Manual: use either full-time equivalents or total employed for both HRST and all employees.*
14. Public sector S&T expenditures including R&D) as a percent of government budgtary allocations – *Government budgetary allocations forecast current and capital expenditures, including funds from international agencies, but excluding debt repayments.*
15. HRST workers as a percent of employed labour force – *Employed labour force is all individuals active in the formal economy.*
16. HRST-trained workers as a percent of total labour force – *Total labour force is employed labour force plus all individuals 15 years and older available for work.*
17. Percent of total labour force with post-secondary education
18. GERD as a percent of GDP
19. Distribution of HRST by sector:

Sector	HRST (number)	% females	% < 35 yrs. old	HRST % employed labour force	Expatriate HRST % of total	Expatriate HRST % CARICOM
Non-renewable resources, plus associated primary mfg.						
Renewable resources plus associated primary mfg.						
Secondary manufacturing						
Private sector services (except tourism)						
Tourism						
Public sector services (except tourism-related)						

Notes:

1. HRST is defined as all individuals who have post-secondary education in at least one of the fields of study as defined in the Canberra Manual, Annex 3, Table 6, sections 1, 2, 3, 4, 5.1, 5.2, 5.3 and 6.1, or are employed in an HRST occupation as defined in Annex 4 of the Canberra manual.
2. An expatriate is an individual who is working in the nation who is normally resident elsewhere regardless of citizenship or place of birth.
3. Primary manufacturing is any sector of industry where the major inputs are raw, natural resources, whether renewable or non-renewable.
4. Tourism activities are those defined by the local tourist board.

20. Distribution of S&T spending by Sector (National Currency)

Sector	S&T Expend.	R&D Expend.	S&T % Extramural	S&T % Capital	S&T % Salaries
Non-renewable resources, plus associated primary mfg.					
Renewable resources plus associated primary mfg.					
Secondary manufacturing					
Private sector services (except tourism)					
Tourism					
Public sector services (except tourism-related)					

Note: S&T expenditures are those expenditures resulting from the activities of all individuals in HRST occupations.

Each national contribution would also include and S&T policy statement, as outlined above.

Future Studies

As a result of focusing on human resources for S&T rather than S&T related expenditures, the workshop identified areas where there is need for additional coordinated studies within the CARICOM region. Specific studies could include:

- the magnitude and sources of remittances to CARICOM nations from CARICOM nationals with HRST training or who are in HRST occupations resident in other countries.

- the potential for repatriating CARICOM nationals from other nations, whether into HRST occupations or as retirees.

DEFINITIONS

Research and Development (R&D)

Research and development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge of man (culture and society) and the use of this stock of knowledge to devise new applications.

Scientific and Technological Services (STS)

STS are defined as activities concerned with R&D and its contribution to the generation, dissemination and application of scientific and technical knowledge:

(i) S&T services provided by libraries, archives, information and documentation centres, reference departments, data banks and information-processing departments.

(ii) S&T services provided by museums of science and/or technology, botanical and zoological gardens and other S&T collections.

(iii) Systematic works on the translation and editing of S&T books and periodicals.

(iv) Topographical, geological and hydrological surveying; routine astronomical, meteorological and seismological observations; surveying of soils and of plants, fish and wildlife resources; routine soil, atmosphere and water testing; the routine checking and monitoring of radioactivity levels.

(v) Prospecting and related activities designed to locate and identify oil and mineral resources.

(vi) The gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics, e.g. population census, production, distribution and consumption statistics, social and cultural statistics.

(vii) Testing, standardisation, metrology and quality control; regular routine work on analysis, checking and testing, by recognised methods, of materials, products, devices and processes, together with the setting up and maintenance of standards of measurement.

(viii) Regular routine work on the training of clients and other sections of an organisation of independent users which is designed to help make them to make use of scientific, technological and management information.

(ix) Activities relating to patents and licenses; systematic work of a scientific, legal and administrative nature on patents and licenses carried out by public bodies.

CCST DRAFT QUESTIONNAIRE

Survey frame (establishment level):

- All government S&T agencies
- All government-supported institutions (hospitals, libraries, etc.), excluding education
- All post-secondary educational institutions (UWI faculties will fill out separate questionnaires)
- All S&T NGO's and private non-profit institutions
- All S&T professional associations – doctors, engineers, etc. (private practice members only)
- All business enterprises with any S&T employees as defined as HRST in Annex 4 of the Canberra Manual
- CCST will send questionnaires to international S&T organisations operating in the Caribbean

1. **HRST**	# Males	# Females	% Expats	% Expats from CARICOM	% < 35 yrs. old
STA professionals (level 6&7)					
STA technicians (level 5)					
STA support staff					
R&D professionals (level 6&7)					
R&D technicians (level 5)					
R&D support staff					
Other employees with level 6&7					
Other employees with level 5					
Total all employees, all levels of education					

2. **Expenditures** (National Currency)	Salaries	Operating	Capital	Total
STA expenditures				
R&D expenditures				
Total				
	Internal	External Public sector	External Private sector	Total
STA expenditures				
R&D expenditures				
Total				

Concordance with RICYT indicators (1999 edition, pp 13 – 18):

RICYT Ind. #	Description	CCST Indicator #
1	Population	1
2	Labour force	2
3	GDP	4
4	Total S&T* expenditures	Available from CCST quest.
5	Total S&T* expenditures/GDP	Data available from CCST quest.
6	Total S&T* expenditures/capita	Data available from CCST quest.
7	R&D expenditures/researcher	Data available from CCST quest.
8	S&T* expenditures by funder	Data available from CCST quest.
9	S&T* expenditures by performer	Data available from CCST quest.
10	S&T* expend. by socio-ec. objective	Data available from CCST quest.
11	S&T* personnel	Data available from CCST quest.
12	S&T* personnel/1000 labour force	Data available from CCST quest.
13	S&T* personnel by gender	Data available from CCST quest.
14	R&D personnel by sector	Data available from CCST quest.
15 – 17	University graduates by level	Approx. data may be available from Min. of Education
16 – 20	Patent data	Numbers may be too small and variable for valid comparisons
23-28	Bibliometric data	Numbers may be too small and variable for valid comparisons

*R&D data may also be available from the CCST questionnaire

DRAFT

REGIONAL SCIENCE & TECHNOLOGY INDICATORS QUESTIONNAIRE CONCEPTS AND DEFINITIONS

1. Scientific and Technological Activities (STA)

These are systematic activities which are closely concerned with the generation, advancement, dissemination and application of scientific and technical knowledge in all fields of science and technology. These include such activities as R&D, scientific and technical education and training (STET) and the scientific and technological services (STS).

2. Research and Experimental Development (R&D)

Research and experimental development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge of man, culture and society and the use of this stock of knowledge to devise new applications.

3. Scientific and Technological Services (STS)

STS are defined as activities concerned with R&D and its contributing to the generation, dissemination and application of scientific and technical knowledge:

(i) S&T services provided by libraries, archives, information and documentation centres, reference departments, data banks and information-processing departments;

(ii) S&T services provided by museums of science and/or technology, botanical and zoological gardens and other S&T collections;

(iii) Systematic works on the translation and editing of S&T books and periodicals;

(iv) Topographical, geological and hydrological surveying; routine astronomical, meteorological and seismological observations; surveying of soils and of plants, fish and wildlife resources; routine soil, atmosphere and water testing; the routine checking and monitoring of radioactivity levels;

(v) Prospecting and related activities designed to locate and identify oil and mineral resources;

(vi) The gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics, e.g. population census, production, distribution and consumption statistics, social and cultural statistics;

(vii) Testing, standardisation, metrology and quality control; regular routine work on analysis, checking and testing, by recognised methods, of materials, products, devices and processes, together with the setting up and maintenance of standards of measurement;

(viii) Regular routine work on the training of clients and other sections of an organisation of independent users which is designed to help make them to make use of scientific, technological and management information; and

(ix) Activities relating to patents and licenses; systematic work of a scientific, legal and administrative nature on patents and licenses carried out by public bodies.

HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY (HRST)

4. Basic Definition

The definition of HRST needs some explanation. One critical part refers to Science and Technology (S&T). At its widest, science means "knowledge" or "knowing". In a narrower sense it is understood as being the kind of knowledge of which the various "sciences" like mathematics, physics or economics are examples. Science is often synonymous with the natural sciences. To overcome differences of opinion about the exact scope of "science" we have opted for a broad definition. We then recommend a greater focus on disciplines that appear particularly relevant. Defining technology seems less controversial: it is the "application of knowledge" and more narrowly dealing with tools and techniques for carrying out the plans to achieve desired objectives.

In order to obtain a complete picture of both supply and demand for HRST, the definition is based on two dimensions, qualification and occupation. The qualification aspect tells about the supply of HRST i.e. the number of people who are currently or potentially available to work at a certain level. The demand of HRST i.e. the number of people who are actually required in S&T activities at a certain level, is related to the occupation dimension. Because demand does not always match supply and because skills can be obtained outside the formal education system, the following combined definition is proposed.

HRST are people who fulfil one or other of the following conditions:

(a) successfully completed education at the third level in an S&T field of study;
(b) not formally qualified as above, but employed in a S&T occupation where the above qualifications are normally required.

5. Education

Education is defined by UNESCO as "organized and sustained communication desired to bring about learning". Education at the third level covers studies leading to awards not fully equivalent to a first degree. Successfully completed education at a given level leads to a formal qualification.

6. ISCED Levels of Education

Seven categories of education, based upon level (plus two residual classes) are incorporated into the ISCED structure (See given below). For the purpose of measuring HRST we are primarily interested in persons with qualifications at ISCED levels 6 and 7. We are also interested in people qualified at ISCED level 5, which would correspond to the ISCO class "Technicians and associate professionals".

ISCED LEVELS OF EDUCATION

0	Education preceding the first level
1	Education at the first level
2	Education at the second level, first stage
3	Education at the second level, second stage
4	(Not attributed)
5	Education at the third level, first stage, of the type that leads to an award not equivalent to a first university degree or equivalent
6	Education at the third level, first stage, of the type that leads to a first university degree or equivalent
7	Education at the level, second stage, of the type that leads to a postgraduate degree or equivalent
8	(Not attributed)
9	Education not definable by level.

7. Professionals

Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and in the management of the projects concerned (ISCED levels 6 & 7)

8. Technicians

Technicians are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences, or social sciences and humanities. They participate in STA by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. Their main tasks include: carrying out bibliographic searches and selecting relevant material from archives and libraries; preparing computer programmes; carrying out experiments, tests and analyses; preparing materials and equipment for experiments, tests and analyses; recording measurements, making calculations; preparing charts and graphs as well as carrying out statistical surveys and interviews.

9. Supporting Staff

Supporting staff includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

10. Expenditure

a) Salaries: This comprises salaries and all associated costs or fringe benefits such as bonus payments, holiday pay, contributions to pension funds, NIS and health surcharge contributions, payroll taxes, etc.

b) Operating Costs: These comprise non-capital purchases of material supplies to support STA performed by the statistical unit in a given year. All expenditures on indirect services should be included here, whether carried out within the organization concerned or hired or purchased from external suppliers.

c) Capital: These are gross expenditures on fixed assets used in STA or R&D programmes. They are composed of expenditures on major and minor instruments and equipment.

Appendix III

Caribbean Science and Technology Indicators Programme

CONFIDENTIAL

(NAME OF AGENCY CONDUCTING SURVEY)
SURVEY OF RESOURCES DEVOTED TO SCIENTIFIC AND TECHNOLOGICAL ACTIVITIES

Due date for submission: _____

Name of Establishment: _____

Address: _____

Name of Contact Person: _____

Telephone Number: _____ Fax Number: _____

Email: _____

Web Page Address: _____

Major Activity of Establishment/Institution:

_____

Year in which established: _____

_____ _____
Signature of person completing Date

Questionnaire

Q. 1 Does your Establishment/Institution allocate any resources (finance/personnel) to *Scientific and Technological Activities (STA)*? **(Before filling, see definition below).** ☐ **Yes** ☐ **No**

If yes, please complete this questionnaire

Definition

Scientific and Technological Activities (STA)

Systematic activities which are closely concerned with the generation, advancement, dissemination and application of scientific and technical knowledge in all fields of science and technology. These include such activities as *Research and Development (R&D)* (defined below), *Scientific and Technical Education and Training* (STET) (defined below) and the *Scientific and Technological Services* (STS) (defined below.)

Q2. HUMAN RESOURCES

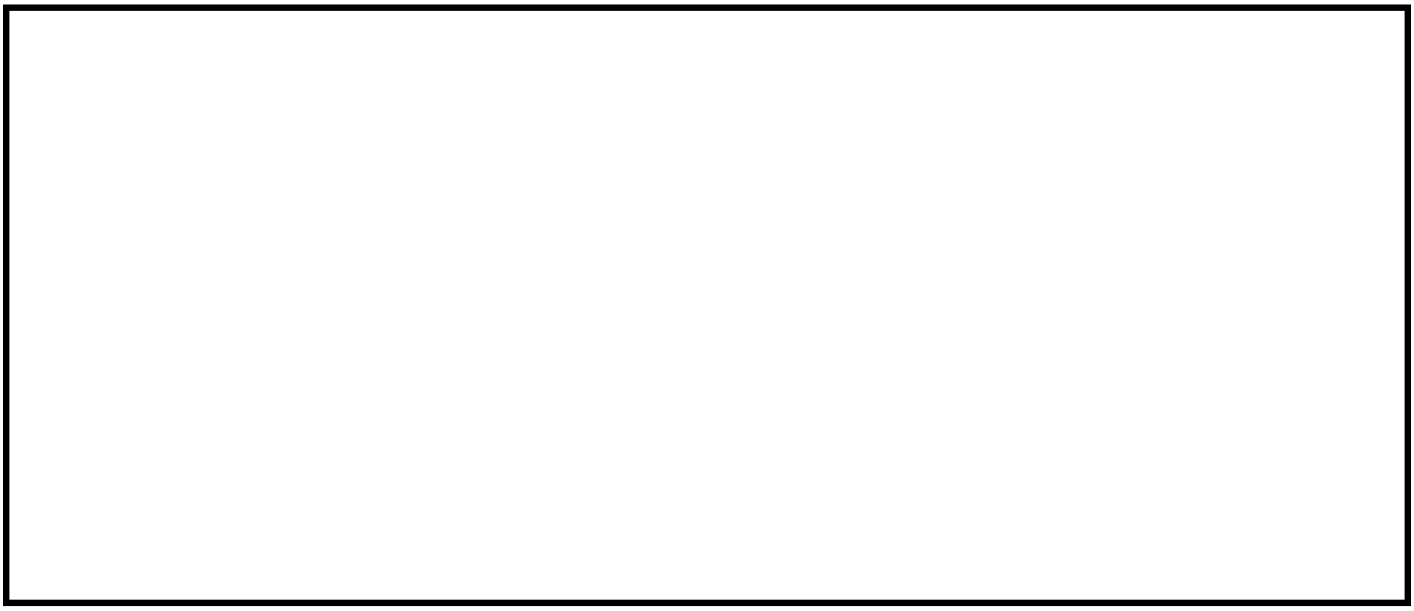
Give the number of persons in your establishment engaged in *Science and Technology Activities* as of **July 1st. (Before, read definitions given below).**

Category of Persons	Number of Persons			
	1998		1999	
	Male	**Female**	**Male**	**Female**
a) Researchers				
b) Post-graduate students				
c) Technicians and Equivalent staff				
d) Scientific (STS) personnel				

Q.3 EXPENDITURE

3.1 Expenditure on *Research and Development (R&D)*
(Before filling out read the definition given below)

Type of Expenditure	Expenditure ($)	
	1998	**1999**
a) <u>Current</u> Labour Cost Other current cost		
b) <u>Capital</u> Land and building Major instruments and equipment		
Total (a + b)		



3.2 Expenditure on *Scientific and Technological Services (STS).*
(Before filling out read the definition given below).

Type of Expenditure	Expenditure ($)	
	1998	**1999**
c) Current Labour Cost Other current cost		
d) Capital Land and building Major instruments and equipment		
Total (a + b)		

Note: For definitions of current and capital costs see page 4.

3.3 Expenditure on *scientific and technological education and training (STET)*
(Before filling out read the definitions given below)

Type of Expenditure	Expenditure ($)	
	1998	**1999**
e) Current Labour Cost Other current cost		
f) Capital Land and building Major instruments and equipment		
Total (a + b)		

Note: For definitions of current and capital costs see page 4.

Definition

Scientific and Technological Education and Training (STET)

Any activity comprising specialised non-university higher education and training, higher education and training leading to a university degree, post-graduate and further training or organised lifelong training for scientists and engineers.

Q.4 MISCELLANOUS

4.1 What fraction of employees have access to the Internet at the workplace?

☐ 75-100% ☐ 50-74% ☐ 25-49% ☐ <25%

4.2 Has your establishment registered any patents? ☐ **Yes** ☐ **No**

Number_____

4.3 Has your establishment produced any papers for publication? ☐ **Yes** ☐ **No**

Number_____

COMMENTS

Do you have comments on how Science and Technology may be used to improve your establishment?

_____
_____
_____
_____
_____

Thank you for taking the time to complete this questionnaire. Please return to the:

Name and Address of Executing Agency

If you have any questions, please contact (Institute) at (telephone number)

All data collected through this survey will be treated as strictly confidential. No establishment or individual will be in any way identified in any reports or publications based on this survey.

Appendix IV

STATUS OF SCIENCE AND TECHNOLOGY INDICATORS IN TRINIDAD & TOBAGO

1. SURVEY OF S&T INDICATORS

Introduction

Trinidad and Tobago is the southernmost island in the Caribbean Archipelago, only 10 km (seven miles) off the Venezuelan coast. It has a population of 1.3 million and an area of 1,980 square miles.

Research into Science and Technology Indicators in Trinidad and Tobago is fairly new. Preliminary work is currently being conducted by the National Institute of Higher Education, Research, Science and Technology (NIHERST).

With the growing need for information on Science and Technology Indicators, Trinidad and Tobago, in March 1999, began the collection of macro level data in the field of S&T which included Research and Development (R&D) expenditure, S&T expenditure, R&D manpower, S&T manpower and an opinion check of organisations on the availability of resources to carry out R&D activities.

Questionnaire Design

Before undertaking the survey, considerable thought was given to defining the objectives of the study and designing the survey tools. The information requested by RICYT and that required by NIHERST was taken into account. Bearing this in mind, a questionnaire was developed which would gather the necessary information. Due to the type of data which was being requested, the nature of the subject matter and the various methods of measuring indicators of expenditure and manpower, it was necessary to develop a list of concepts and definitions as an attachment to the questionnaire. The development of this list was guided by information in the Frascati Manual and took into account the country's relative ignorance of the subject matter.

The questionnaire mainly sought information on two important input parameters: - the number of personnel employed in S&T and R&D activities and relevant expenditure. Details were requested on two parameters, the break up of R&D and S&T expenditure into revenue and capital expenditure for the 1996 – 1997 period. The qualifications of R&D and S&T personnel were further broken down by gender. Apart from this, information on ongoing R&D projects was also requested. This included the title of the project, project description, objectives, duration, sponsor and budget. Organisations were requested to give their opinion on the extent of problems faced in carrying out R&D activities due to certain factors such as manpower, training, funding, encouragement, facilities, environment and bureaucracy.

Survey Methodology

The present survey covers the Government, private and higher education sectors. The questionnaire was mailed to 93 organisations.

The method of contact employed was one in which the questionnaire and the list of concepts and definitions were mailed or hand delivered to organisations and a deadline given. A period of two weeks was allowed for the receipt of questionnaires after which appointments were made to meet with representatives of organisations in order to clarify concepts and definitions and to explain the method in which they should be applied to the various institutions based on their type of activity.

The completed questionnaires were checked for consistency and completeness of data and wherever necessary, queries were referred back to the respondents. The response rate is 60%.

Information and Analysis

Data is being compiled and will be available shortly.

Following is a brief summary of the information which will be available.

- Total S&T expenditure by sectors
- Total S&T expenditure by revenue and capital expenditure
- Total expenditure as a percentage of Gross National Product
- Total R&D expenditure by various sectors
- Total R&D expenditure by revenue and capital expenditure
- R&D expenditure as a percentage of Gross National Product
- S&T personnel by sector
- R&D personnel by sector
- S&T and R&D personnel by qualifications
- Distribution of S&T and R&D personnel by gender
- Analysis of opinions on the factors affecting R&D

Secondary Sources

- Macro Socio-economic indicators
- Expenditure on higher education
- Registration of students at under graduate and post graduate level
- Degrees awarded for graduate, post graduate and PhD level
- Registration of students in technical and vocational courses

LIMITATIONS

⇒ As this is the first attempt by Trinidad and Tobago in collecting data on S&T Indicators, a situation has developed where much time and energy must be invested in the task of promoting the need for and use of such data and in translating the various concepts used in the study.

⇒ A major problem in the survey is the receipt of the questionnaire on time.

⇒ At present, no national laws/mandates/statutory provisions relating to the procurement of S&T statistics from S&T establishments exist.

⇒ Industries are not maintaining separate accounting systems for R&D or S&T expenditure.

RECOMMENDATIONS

⇒ That an exercise be undertaken to focus on developing or adapting current concepts to the Caribbean context;

⇒ Sensitisation of the public to the use and need for information on S&T Indicators;

⇒ A policy decision is required to encourage industries to maintain separate accounts for S&T and R&D;

⇒ Statutory provisions need to be made in order to facilitate the procurement of S&T statistics from establishments; and

⇒ Use of experts in this field to educate respondents on the impact of such research on policy development.

2. SURVEY FOR THE IDENTIFICATION OF S&T INSTITUTIONS

In January 2000, the NIHERST S&T Statistical Unit began a survey for the identification of S&T institutions.

The objectives of this study were:

- To identify organisations in Trinidad and Tobago which were involved in S&T activities;
- To create a database of institutes involved in S&T and R&D; and
- To gain some insight into innovation in companies in Trinidad and Tobago.

Methodology

All organisations in Government, higher education (UWI) and industry were contacted.

Government: The Permanent Secretaries of all Ministries were contacted and asked to identify departments/divisions under their administration, involved in S&T/R&D and heads of divisions were sent the questionnaires.

Higher Education: Deans were sent the questionnaires

Industry: A complete list of organisations was sourced from the Central Statistical Office (CSO). A sample was selected based on the employment size and these companies were sent the questionnaires.

A total of 230 organisations received questionnaires and to date 75 have been completed and returned. Outstanding organisations are being contacted and follow up visits made to ensure completion of the exercise by August 2000. A copy of the questionnaire is attached for your information.

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SURVEY OF SCIENCE AND TECHNOLOGY INDICATORS

TO BE COMPLETED AND RETURNED TO NIHERST S&T DIVISION
20 VICTORIA AVENUE, PORT OF SPAIN

I

Questionnaire Number: _____

Due date for submission to NIHERST: _____

Name of Establishment: _____

Address: _____

_____

Activity of Establishment: _____

1. MANPOWER

1.1 State the number of persons in your organization engaged in Science and Technology Activities. **(See Concepts and definitions No. 1 to 10)**

Category of Persons	Number of Persons			
	1996		1997	
	Male	Female	Male	Female
i) Researchers				
ii) Technicians and Equivalent Staff				
iii) Scientific (STS) Personnel				
iv) Postgraduate Students				
v) Other Support Staff				

1.2 For the year **1997** only, please complete the following table for the personnel in categories (i) Researchers (ii) Technicians and Equivalent Staff and (iii) STS Personnel as stated in Question 1.1 above.

NAME	QUALIFICATION[1]	FIELD[2]	**Enter: 1.** for S&T Activity **2.** for R&D activity only **3.** for both

NOTE: Please attach additional sheets if necessary

[1] See Concepts & Definitions # 9
[2] See Concepts & Definitions # 10

2. **EXPENDITURE**

2.1 Total Expenditure on Science and Technology Activities

(See Concepts and Definitions No. 1 & 11)

Type of Expenditure	**Expenditure (TT$)**	
	1996	1997
a) Current: Labour costs Other current costs		
b) Capital Land and building Major instrument and equipment		
TOTAL		

2.2 Total Expenditure on Research and Experimental Development

(See Concepts & Definitions No. 2 & 11)

(See Concepts and Definitions No. 1 & 11)

Type of Expenditure	**Expenditure (TT$)**	
	1996	1997
c) Current: Labour costs Other current costs		
d) Capital Land and building Major instrument and equipment		
TOTAL		

3. **RESEARCH & DEVELOPMENT PROJECTS IN 1998**

Please provide details of Research and Development Projects undertaken by your establishment durng 1998

Title of project	Description	Objectives	Duration	Sponsor	Budget (TT$)

NOTE: Please attach additional sheets if necessary

4. **PROBLEM AREAS IN RESEARCH & DEVELOPMENT**

(a) Have you encountered any problems in carrying out the research mentioned in Question 3 above? (please tick the appropriate box) Yes [ ] No [ ]

(If "no" to Q4 (a), omit Q 4(b))

(b) To what extent were the following factors a problem in carrying out your research? Please tick the appropriate box)

		Not at all	To some extent	To a great extent
1.	Manpower Deficiency	[ ]	[ ]	[ ]
2.	Lack of Training	[ ]	[ ]	[ ]
3.	Inadequate funding	[ ]	[ ]	[ ]
4.	Lack of encouragement	[ ]	[ ]	[ ]
5.	Inadequate facilities	[ ]	[ ]	[ ]
6.	Unsuitable environment	[ ]	[ ]	[ ]
7.	Bureaucracy	[ ]	[ ]	[ ]
8.	Other	[ ]	[ ]	[ ]

_____

Please specify.

_____ _____ _____

Date Signature of person Completing return Position held

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NATIONAL INSTITUTE OF HIGHER EDUCATION,
RESEARCH, SCIENCE AND TECHNOLOGY (NIHERST)

SURVEY FOR IDENTIFICATION OF SCIENTIFIC AND TECHNOLOGICAL (S&T) INDUSTRIES

Due date for submission to NIHERST: _____

Name of Establishment: _____

Address: _____

Name of Contact person: _____

Telephone Number: _____ Fax Number: _____

Email: _____

Major Activity of Company: _____

Year in which established: _____

_____ _____

Signature of the person completing questionnaire

Date

Note: ***Please tick [√] the boxes in the following questions as applicable***

Q1. Does your company allocate any company resources (finance, time and/or effort to Research and Development (R&D)**? ☐ Yes ☐ No

1.1 Has this ever been done in the past? ☐ Yes ☐ No

1.2 Do you plan to do so in the future? ☐ Yes ☐ No

Q2. Is your Company involved in the following activities:

	Yes	No
➢ Patent development?	☐	☐
➢ New process development?	☐	☐
➢ New product development?	☐	☐
➢ Prototype development?	☐	☐
➢ Technological changes in processes?	☐	☐
➢ New design development?	☐	☐
➢ Import substitution development?	☐	☐
➢ Publication of research papers/books	☐	☐
➢ Undertake research projects?	☐	☐
➢ Employment of researchers?	☐	☐
➢ Research by postgraduate or Ph.D. students?	☐	☐
➢ Retraining personnel in new techniques or use of new machinery?	☐	☐
➢ Modification of production machinery and tools?	☐	☐
➢ Provide ** scientific and technological services to perform above given activities?	☐	☐

***** (See definitions on page 7 of this questionnaire before ticking)***

Q. 3 Do you maintain a separate budget for R&D activities? ☐ Yes ☐ No

Q. 4 Do you have separate manpower for R&D projects? ☐ Yes ☐ No

Q. 5 Do you have sufficient infrastructure facilities available for performing R&D activities? ☐ Yes ☐ No

Q. 6 Nature of R&D carried out at present:

- Planned or systematic ☐ Yes ☐ No
- Trouble shooting or ad hoc ☐ Yes ☐ No
- Quality Control ☐ Yes ☐ No
- Others (Please specify) ☐ Yes ☐ No

Q. 7 Has your Company introduced any new products or processes in the past five years? ☐ Yes ☐ No

Q. 8 Please indicate how often your Company, on the average, introduces new products or processes.

- More than three times a year ☐
- Three times a year ☐
- Twice a year ☐
- Once a year ☐
- Every second year ☐
- Every third year ☐
- More seldom than every third year ☐

Q. 9 To what extent does your organisation:

	Low	Medium	High
➢ Have a stated and working strategy of product/process innovation?	☐	☐	☐
➢ Treat employees as a vital resource for building competitive advantage in products/processes?	☐	☐	☐
➢ Hold creative product/process employees and their contributions in high esteem?	☐	☐	☐
➢ Celebrate new product/process success?	☐	☐	☐
➢ Have product/process idea people?	☐	☐	☐
➢ Train employees to be creative for product/process development?	☐	☐	☐
➢ Have effective suggestion programmes for products/processes?	☐	☐	☐

	Low	Medium	High
➢ Manage organisational culture to make it more innovative for product/process development?	☐	☐	☐
➢ Empower subordinates: delegate sufficient authority for employees to innovate new/products processes?	☐	☐	☐
➢ Invest heavily and appropriately in product/process R&D	☐	☐	☐

Q. 10 In general, how did this new product/process affect your Company's:

	Negatively	No Effect	Positively
➢ Profitability	☐	☐	☐
➢ Cash Flow	☐	☐	☐
➢ Market Share	☐	☐	☐
➢ Competitiveness	☐	☐	☐
➢ Productivity	☐	☐	☐
➢ Environmental Impact	☐	☐	☐
➢ Quality of Service	☐	☐	☐
➢ Labour Relations	☐	☐	☐
➢ Other	☐	☐	☐

Q. 11 How valuable are the following in developing your new products and/or processes?

	Not Valuable	Valuable	Crucial
➢ In-house R&D	☐	☐	☐
➢ Out sourced R&D	☐	☐	☐
➢ Sale and Marketing	☐	☐	☐
➢ Production	☐	☐	☐
➢ Management	☐	☐	☐
➢ Competitors	☐	☐	☐
➢ Customers	☐	☐	☐
➢ Suppliers	☐	☐	☐
➢ Trade Shows	☐	☐	☐
➢ Other	☐	☐	☐

_____

Q. 12 How do the following factors influence innovation in your Company?

	Hinder	No Effect	Help
➢ Corporate culture	☐	☐	☐
➢ Management attitude	☐	☐	☐
➢ Risk or Reward innovation	☐	☐	☐
➢ Development and/or production cost	☐	☐	☐
➢ Clients	☐	☐	☐
➢ Competition	☐	☐	☐
➢ Supplies of raw material	☐	☐	☐
➢ Government policies or programmes	☐	☐	☐
➢ Availability of personnel	☐	☐	☐
➢ Availability of financing	☐	☐	☐
➢ Environmental concerns	☐	☐	☐

Q. 13 Has your company updated or replaced capital equipment in the past five years? ☐ Yes ☐ No

If yes, did the new equipment incorporate significant technological advances? ☐ Yes ☐ No

Q. 14 Is there one person at your Company responsible for managing innovation? ☐ Yes ☐ No

Q. 15 Is your Company able to measure the quality and Effectiveness of its innovative practices? ☐ Yes ☐ No

Q. 16 Does your company use the Internet? ☐ Yes ☐ No

If yes, what percentage of your employees has access to the Internet from their desks?

☐ All employees	☐ 25% - 49%
☐ 75% -99%	☐ 10% - 24%
☐ 50% - 74%	☐ less than 10%

Q. 17 If your organisation/institution uses Internet, do you use it

a) For e-mail? ☐ Yes ☐ No

b) For searches on the World Wide Web? ☐ Yes ☐ No

c) For selling, not just advertising, your goods and services? ☐ Yes ☐ No

Q. 18 Does your Company have a home page on the World Wide Web? ☐ Yes ☐ No

Q. 19 Does your Company have programmes, either formal or informal, for employee training and education? ☐ Yes ☐ No

Q. 20 Please give your views/comments on how to boost R&D activities in the country? (Please do not exceed ten lines)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for taking the time to complete this questionnaire. Please return it to the:

National Institute of Higher Education,
Research, Science and Technology (NIHERST)
Science and Technology Division
20 Victoria Avenue
PORT OF SPAIN

If you have any questions, please contact NIHERST at (868) 627-1732

All data collected through this survey will be treated as strictly confidential. No individual or institution will be in any way identified in any reports or publications based on this survey.

DEFINITIONS

Research and Development

Research and development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge of man (culture and society) and the use of this stock of knowledge to devise new applications.

Scientific and Technological Services (STS)

STS are defined as activities concerned with R&D and its contribution to the generation, dissemination and application of scientific and technical knowledge:

(i) S&T services provided by libraries, archives, information and documentation centres, reference departments, data banks and information-processing departments;

(ii) S&T services provided by museums of science and/or technology, botanical and zoological gardens and other S&T collections;

(iii) Systematic works on the translation and editing of S&T books and periodicals;

(iv) Topographical, geological and hydrological surveying; routine astronomical, meteorological and seismological observations; surveying of soils and of plants, fish and wildlife resources; routine soil, atmosphere and water testing; the routine checking and monitoring of radioactivity levels;

(v) Prospecting and related activities designed to locate and identify oil and mineral resources;

(vi) The gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics, e.g. population census, production, distribution and consumption statistics, social and cultural statistics;

(vii) Testing, standardisation, metrology and quality control; regular routine work on analysis, checking and testing, by recognised methods, of materials, products, devices and processes, together with the setting up and maintenance of standards of measurement;

(viii) Regular routine work on the training of clients and other sections of an organisation of independent users which is designed to help make them to make use of scientific, technological and management information; and

(ix) Activities relating to patents and licenses; systematic work of a scientific, legal and administrative nature on patents and licenses carried out by public bodies.

Appendix V

CARIBBEAN SCIENCE AND TECHNOLOGY INDICATORS PROGRAMME

NAME	ORGANISATION	ADDRESS	TELEPHONE	FAX	EMAIL
Daniel Deen	NIHERST	8 Serpentine Rd., St. Clair, Trinidad	(868) 628-1154	(868) 628-2069	Niherst@opus.co.tt
Donnalyn Charles	Sustainable Development & Environment Unit Ministry of Planning, Development, Housing & Environment	1st Floor Graeham Louisy Administration Bldg. Castries Waterfront P.O. Box 709 Castries, St. Lucia	(758) 451-8746	(758) 452-2506	Estplanning@candw.lc
Donatus St. Aimee	UNECLAC	Box 1113 Port of Spain, Trinidad	(868) 623-5595 Ext 370	(868) 623-8485	Dstaimee@eclacpos.org
Elizabeth Lloyd	NIHERST	8 Serpentine Rd., St. Clair, Trinidad	(868) 628-1154	(868) 628-2069	Lizlloyd@yahoo.com
Sonia Gatchair	National Commission on Science and Technology Secretariat	1 Devon Rd, Kingston 10, Jamaica	(876) 960-8345	(876) 960-8407	Ncst.sec@cwjamaica.com
Rakesh Chetal	NIHERST	8 Serpentine Rd., St. Clair, Trinidad	(868) 628-1154	(868) 628-2069	Chetalr@yahoo.ccom
Troy Waterman	National Council for Science and Technology	Reef Rd., Fontabelle, St. Michael, Barbados	(246) 427-5270 (246) 427-1820	(246) 228-5765	Ncstbar@caribsurf.com Tantonio@hotmail.com
David Singh	Institute of Applied Science and Technology	University Campus, Turkeyen, Greater Georgetown, Guyana	(592) 22-4218/3	(592) 22-4229	Iast@networksgy.com